CLAIMS

1. A method of controlling a flow of a fluid sample, comprising:

providing a first fluid as a flow in a microfluidic channel; and

sheathing the first fluid with a second fluid having a known viscosity, such that the first fluid has a flow rate that is substantially equal to a flow rate of the second fluid at the interface with the first fluid.

2. The method of claim 1, further comprising contacting the first fluid with the second fluid.

3. The method of claim 1, wherein the first fluid and the second fluid flow in contact with each other.

4. The method of claim 1, wherein sheathing the first fluid includes injecting the second fluid into the channel at least partially around the first fluid.

5. The method of claim 4, wherein the second fluid is injected on either side of the first fluid in a two-dimensional sheath flow.

6. The method of claim 4, wherein the second fluid completely surrounds the first fluid in a three-dimensional sheath flow.

7. The method of claim 6, wherein the three-dimensional sheath flow has a rounded cross-sectional profile.

8. The method of claim 6, wherein the three-dimensional sheath flow has a squared cross-sectional profile.

9. The method of claim 1, wherein the second fluid is configured to minimize contact of the first fluid with an internal surface of the microfluidic channel.

10. The method of claim 10, wherein the second fluid is configured to insulate the first fluid from contact with an internal surface of the microfluidic channel.

11. A method of controlling a flow of a fluid sample, comprising:

providing a first fluid as a flow in a microfluidic channel, the first fluid having an unknown or variable viscosity; and

sheathing the first fluid with a second fluid having a known viscosity, such that the first fluid has a flow rate that is substantially equal to a flow rate of the second fluid at the interface with the first fluid.

12. The method of claim 11, wherein the known viscosity of the second fluid is adapted for maintaining a particular flow rate for the first fluid in the microfluidic channel.

13. An apparatus for controlling a flow of a fluid samples in a microfluidic channel, comprising:

a first fluid, provided as a flow in the microfluidic channel;

a second fluid, provided as a flow between an internal surface of the channel and the first fluid, the second fluid having a known viscosity tailored to achieve a constant flow rate at a the interface with the first fluid, such that the first fluid achieves substantially the constant flow rate independent of a viscosity associated with the first fluid.

14. The apparatus of claim 13, wherein the second fluid sheaths the first fluid.

15. A method of controlling a flow of a fluid sample, comprising:

providing a first fluid as a flow in a microfluidic channel; and

providing a second fluid as a flow in the microfluidic channel between the first fluid and an internal surface of the channel, the second fluid having a known viscosity, such that the first fluid has a flow rate that is substantially equal to a flow rate of the second fluid at the interface with the first fluid.

16. The method of claim 15, wherein the second fluid sheaths the first fluid.

17. A system for performing a microfluidic process, comprising:

a microfluidic channel, having a first inlet for receiving a first fluid flow and a second inlet for receiving a second fluid flow in between the first fluid flow and an internal surface of the channel, the second fluid having a viscosity that is selected for achieving a particular, constant flow rate at the interface with the first fluid, such that the first fluid flow achieves a flow rate that is substantially equal to the flow rate of the second fluid at the interface with the first fluid.

18. The system of claim 17, wherein the second inlet surrounds the first inlet.

19. The system of claim 17, wherein the first and/or the second inlets are squared.

20. The system of claim 17, wherein the first and/or second inlets are rounded.

21. The system of claim 17, wherein the first fluid has an unknown or variable viscosity.

22. A method of controlling a flow of a fluid sample, comprising:

injecting a first fluid into a microfluidic channel; and

injecting a second fluid into the channel adjacent to the first fluid, the second fluid having a known viscosity, such that the first fluid has a flow rate that is substantially equal to a flow rate of the second fluid at the interface between the first and second fluid.

23. The method of claim 22, wherein injecting the second fluid further includes forming a sheath around the first fluid with the second fluid.

24. The method of claim 23, wherein the second fluid insulates the first fluid from contact with an internal surface of the microfluidic channel.

25. A method of controlling a flow of a fluid sample, comprising:

providing a first fluid as a flow in a microfluidic channel, the first fluid containing non-dissolved particles that are susceptible to forces which affect the flow of the first fluid; and

sheathing the first fluid within a second fluid having a controlled flow, so as to substantially insulate the first fluid from the forces.

26. The method of claim 25, wherein the forces include hydrodynamic shear stress within the microfluidic channel.

27. The method of claim 25, wherein the second fluid has a known viscosity selected for achieving a particular flow profile within the microfluidic channel.

28. A method of controlling a flow of a fluid sample, comprising:

providing a first fluid as a flow in a microfluidic channel, the first fluid containing non-dissolved particles that are susceptible to forces which affect the flow of said non-dissolved particles within said microfluidic channel; and

sheathing the first fluid within a second fluid having a controlled flow, so as to substantially insulate said first fluid from the forces.

29. A method of controlling a flow of a fluid sample, comprising:

providing a first fluid as a flow in a microfluidic channel, the first fluid containing non-dissolved particles that are susceptible to forces which are substantially perpendicular to the direction of flow within said microfluidic channel; and

sheathing the first fluid within a second fluid having a controlled flow, so as to substantially insulate said first fluid from the forces.

30. The method of claim 29, wherein the forces include hydrodynamic shear stress within the microfluidic channel.

31. The method of claim 29, wherein the forces include hydrodynamic shear lift within the microfluidic channel.

32. The method of claim 29, wherein the forces include elastic collisions of particles within the microfluidic channel.